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Prevalence of *Ceratothoa oestroides* (RISSO, 1826), a cymothoid isopode parasite, in cultured sea bass *Dicentrarchus labrax* L. on two farms in middle Adriatic Sea

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During the spring months on two finfish facilities in island Kornati aquatory, growth retardation, emaciation and 10 % mortality of sea bass fingerlings was noticed, even though all zooprofilactic and nutritional measures were carefully conducted.

From the buccal cavity of obvious kahectic and anorexic animals, a cymothoid isopode, Ceratothoa oestroides, *was isolated and identified. The identification was followed on the basis of TRILLES' studies.*

The prevalence of infection and some morphometric parameters of the host and the parasite were measured and statistically analyzed.

Both farms had almost one third of sampled fish infected (25, 6 and 27, 5 % respectively). The results showed statistically significant decrease in total body weight of infected fish versus uninfected ones (17, 3 and 66, 7 % respectively).

The parasite, although nonspecific and widely distributed in all Adriatic, seams to cause major damage in young categories of sea bass, and it's more frequent than in a sea bream's fingerlings (Sparus aurata, L.), *reared in the same facility. This could be explained with fingerling's preferences and feeding habits. Older animals are rarely susceptible to the infection, depending however, on zoo-technical conditions on the farm.*

Key words: *Ceratothoa oestroides,* prevalence of infection, sea bass

INTRODUCTION

Ceratothoa oestroides is ubiquitous and nonspecific parasite of fish from different biotopes. It belongs to family Cymothoidae, exclusively made of parasitic species. It has been found in six different fish families - Sparidae, Carangidae, Clupeidae, Maenidae, Scorpaenidae and Mugilidae, but it has been most frequently isolated from bogue (*Boops boops*) (CHARFI-CHEIKHROUKA *et al.*, 2000). In Bay of Boka Kotorska TRILLES *et al.* (1989) found this parasite in addition to bogue, also in a Mediterranean horse-mackerel (*Trachurus mediterraneus*), annular sea bream (*Diplodus annularis*), common pandora (*Pagellus erythrinus*), and in pickarel (*Spicara smaris*). Although relatively rare in Mediterranean, *Ceratothoa oestroides* is usually found parasiting Sparidae and Centracanthidae (TRILLES, 1989).

As for reproductive features of *C. oestroides*, the female bears embryonated eggs in a brood pouch; they develop first in pulli I, than in pulli II, III with rudimental pereiopods of VII pair, and eventually in pulli IV, when the post larval evolution begins.

As proteandric hermaphrodites, the parasite passes from the male puberty stage, through prolonged male puberty stage, transition or sexual inversion stage, to female puberty stage and finally, the prolonged female puberty stage (TRILLES, 1969). During the male puberty stage, the parasite loses its swimming capabilities, and once fixated in the buccal cavity of its host, becomes quite incapable for actively migrating to another host. This fact is very important for epizootic evaluation of the routs of infection.

After the fixation on the host is completed, the parasite begins haematophagous nourishment that includes successive cycles of blood sucking and blood absorption in parasite's intestine (TRILLES, 1969).

Because of sedentary mode of life in well sheltered buccal cavities, some adaptations of the parasite have evolved, such as thinner cuticular mineralisation, pleopods of three last pair transformed in respiratory organs, thinner incubation chamber (TRILLES, 1969).

Since the fixation on the host can occur only over a short period in life, constant fertility of females is a necessity; therefore they maintain their reproductive condition throughout the year, although seasonal variations in the fecundity rate exist. TRILLES (1964b) found in July the highest prevalence of gravid females (90 %), with fecundity ranging from 40 to 396 eggs.

The scope of this article is to investigate the infection by *C. oestroides* in cultured sea bass *Dicentrarchus labrax* (LINNAEUS, 1758) in two aquaculture facilities located in middle Adriatic Sea, along the Croatian coast. The prevalence of the isopod, fecundity rate and seasonal prevalence of the females, and the impact on the fish populations in the intensive cage-rearing system were observed.

MATERIAL AND METHODS

Fingerlings of sea bass were sampled from two nearby offshore semi-intensive facilities near Kornati islands, in March and June, respectively.

From facility A, a total number of 78 sea bass fingerlings were sampled, and from facility B 109, respectively. Fish from a net pan were sampled by a net and individually inspected for the presence of an isopod parasite in the buccal cavity. Live isopodes were collected and immediately fixed in 70% ethanol solution.

In the laboratory, both infected and uninfected fish were measured and examined. Isopods were measured, washed in distilled water, and dissected in glycerol under the dissecting microscope. The body parts were identified following TRILLES studies (1962, 1963); TRILLES and RAIBAUT (1971, 1973) and TRILLES *et al.* (1999) and a monography (RICHARDSON, 1905).

Statistical analysis were conducted using STATISTICA Version 5.0 software, and calculated by STUDENT's t-test.

RESULTS

Parasite morphology

Adult body of a parasite is oval elongated and straight, piriform in female, more eliptic in male. Head is little and sets well in the first thoracic segment, with laterally set and well-developed eyes. The first pair of antennae is contiguous at the base, while the second pair is longer, well developed and convex. Anterior edge of the head is more or less convex medially, appearing almost triangular in adult female.

Mesosoma segments decrease slowly in the length from first to the last segment, with the fifth segment being the most wide in female, while in the male, the last six segments are equal.

The seventh thoracic segment has a concave posterior edge carrying well-immersed abdomen. Abdomen segments are narrow, almost equal in width, with well-rounded, well-developed telson, wider than longer. Two pairs of

Table 1. Prevalence of infection, total weight and growth reduction in sampled fish from two facilities

	Wt infected (g)	Wt uninfected (g)	prevalence (%)	infected (N)	uninfected (N)	growth reduction (%)	P-value
facility A	7.6 ±2.41	9.19 ±1.80	25.6	20	58	17.3	0.065
facility B	29.27±19.87	87.91 ±16.10	27.5	30	69	66.7	0.094

uropods are almost equal in length and a bit longer than the telson.

Pereiopods are strong, with wide, compact basipod, and very convex ungulae. The last pair of pereiopods is the longest (Figs. 1, 2, 3, 4).

Prevalence of the infection

Both neighboring mariculture facilities showed similar prevalence of the isopod: 26.1% and 27. 4%, respectively.

The major number of female parasites (72%) carried pulli I or II, and measured 2.11 cm ± 3.15, while the females with only embryonated eggs measured 1.85 cm ± 1.24. The male parasite had a prevalence of 63.2%, and 51.3% respectively, in the infected population of fish, and the mean length measured 1.17 cm ± 0.2. Pulli II measured 0.35 cm ± 0.04, and pulli I 0.17 ± 0.01.

Females bore 183 ± 26 of embryonated eggs, 124 ± 16 pulli I and 83 ± 21 pulli II.

Parasitized fish from one facility, sampled with smaller weight, showed 17.3% reduction in weight, compared with uninfected ones. In older parasitized fingerlings from the other facility, the reduction was 66.7%.

The STUDENT's t-test showed that there is a statistically significant difference ($P < 0.05$) between the total body weight of infected and uninfected fingerlings of both farms. Results are showed in Table 1.

DISCUSION

Until now there were just few reported cases of Cymothoidea infection in cage-reared sea bass, with serious epizootic outbreaks (BRAGONI *et al.*, 1984, PAPAPANGIOTOU *et al.*, 1999), but only two aethiologicaly concerning *C. oestroides* (ŠARUŠIĆ, 1999; HORTON and OKAMURA, 2001).

The prevalence of infection in fingerlings on observed facilities in Kornati aquatory were almost similar, reaching 25.6 and 27.5%, respectively. Other authors observed a prevalence ranging from 1 to 68% on the same farm (mean 23.11%), that varied dramatically even between cages of fish of similar ages (HORTON and OKAMURA, 2001). The cause may be in the different seasons of sampling, because although the female of *C. oestroides* is fertile over the whole year, the fecundity rate oscillates seasonally (TRILLES, 1964b).

ŠARUŠIĆ (1999) stated that mortality in fingerlings reached from 10 to 20 %, while sampled adult had a very low prevalence of infection, and mortalities were not noticed. In this case, mortalities of fingerlings reached 10 % (personal observation). It can be assumed that adults can act as carriers, together with wild fish, because the fixation of the juvenile parasite cannot be conducted, if for one determinate length of the fish host. That for is quite impossible to find juvenile individuals of *C. oestroides* parasiting adult sea bass and the adult *C. oestroides* has scarce possibility to migrate from one host to another. Also, as the fingerlings grow, the infected ones died out primary because of parasitic impact or secondary, from other aetiology, which they could not overcome. Infected fingerlings rarely reached the adult size, and in this way the number of infected bass decrease in relation with time, lowering the prevalence of the isopod, which is

also evident from this study. This could explain TRILLES (1964a) findings, who stated evidence for correlation between the parasite and fish length concerning *C. oestroides*, but not for all Cymothoid parasite. The correlation was even more prominent for parasites in female stage of life.

However, ŠARUŠIĆ (1999) found an infection during all year in market size sea bass, connected with poor zoo-technical management.

The evident cause of mortality in fingerlings was chronic emaciation caused by anemia, anorexia and decrease of respiration rate, related to a parasite as a mechanical obstacle for water flow from buccal cavity trough gill cavity. In addition to direct loss due to parasite-caused mortality, indirect losses occur because of significant reduction in growth, which, according to ŠARUŠIĆ (1999), can reach 20 %. HORTON and OKAMURA (2001) observed almost similar reduction in fish length between the parasitized and unparasitized fish (20.1%). The parasite significantly depressed growth, reproduction and survivorship of infected fish, what ADLARD and LESTER (1994) successfully evaluated on a population of wild fish in the field. Nevertheless BELLO *et al.* (1997) did not find relationship between the prevalence and the gonadosomatic indices of sand smelt (*Atherina boyeri),* pointing that there is no any effect of the parasite on the reproductive cycle of its host. In this study, the sampled fish were too young for the evaluation of gonadosomatic index, and the percentage of *C. oestroides* in adults was too scarce for exact statistical analysis.

The growth retardation in sea bass fingerlings is evident on both facilities: 17.3 and 66.7%. The lower growth rate in one farm is probably related with age of the sampled stock. That sample was made of older fish, regarding the sample from the other farm, so in the first case the parasitosis lasted longer, and so did the emaciation and anorexia, resulting with higher rate of growth reduction.

The higher prevalence of male parasite in fingerlings is due probably because of a fresh infection with a still immature female or just due to the death and replacement of an old female. Therefore it is normal that male parasites numerically prevail.

The decreasing number of eggs, pulli I and pulli II reflects the unfavorable impact of environmental factors on the gravid female. This points that the infection depends highly on environmental factors, biogeographical characteristics of the farm's location and seasonal conditions. Permanent reservoir of infection are also wild fish species, very abundant near the floating cages, due to the presence of food remains from cages on which fish may feed. Hence, even if the infected fingerlings progressively died out, the circuit of infection can't be interrupted easily.

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Fig. 1. Adults of Cerathothoa oestroides, *showing makred sexual dimorphism (female on the right)*

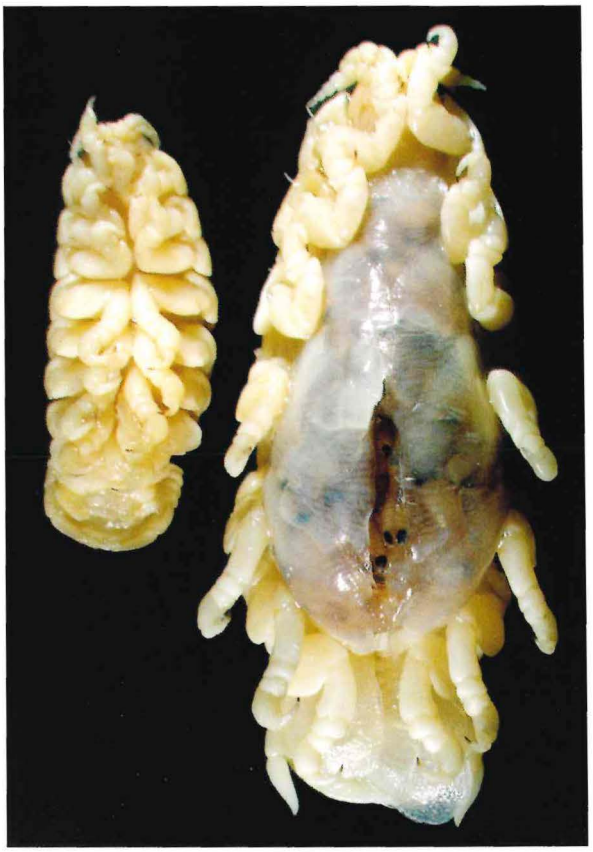

Fig. 2. Ventral view of adult isopods. Note female marsupium with pulli

Fig. 3. Ventral and dorsal view of pulli extipated from female marsupium

Fig.4. Lateral view of adult male

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Prevalencija parazita *Ceratothoa oestroides* (RISSO, 1826), cimotoidnog jednakonošca, na uzgojenom lubinu (*Dicentrarchus labrax*, L.) s dva uzgajališta srednjeg Jadrana

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SAŽETAK

Tijekom proljetnih mjeseci na dvijema uzgajalištima u akvatoriju Kornata, zapaženi su usporavanje rasta, iscrpljenost i smrtnost od 10 % mlađi lubina (*Dicentrarchus labrax*, L.), iako su sve zooprofilaktičke i prehrambene mjere bile pažljivo provedene. Iz usne šupljine vidljivo kahektičnih i anoreksičnih životinja, cimotoidni jednakonožac, *Ceratothoa oestroides* je izoliran i identificiran. Identifikacija je izvedena na osnovi TRILLES-ovih studija.

Prevladavanje infekcije i određeni morfološki parametri domaćina i parazita su izmjereni i statistički analizirani. Oba uzgajališta imala su zaražene skoro jednu trećinu uzorkovane ribe (25,6 i 27,4 %). Rezultati su pokazali statistički značajan pad u ukupnoj težini tijela zaražene ribe, naspram nezaraženim jedinkama (17,3 i 66,7%).

Ovaj parazit, iako nespecifičan i široko distribuiran u Jadranu, čini se da uzrokuje najveću štetu na mlađim kategorijama lubina, gdje je i zastupljeniji nego kod mlađi komarče (*Sparus aurata*, L.) s istog uzgajališta, što bi se moglo objasniti preferencijama i prehrambenim navikama mlađi. Odrasle životinje rijetko su podložne zarazi, što je međutim zavisno o zootehničkim uvjetima na uzgajalištu.

Ključne riječi: *Ceratothoa oestroides*, prevladavanje infekcije, lubin